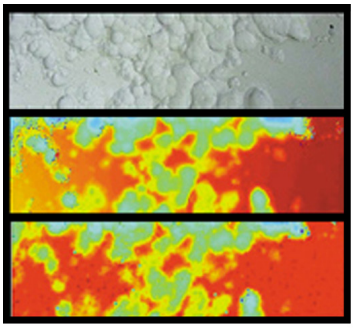
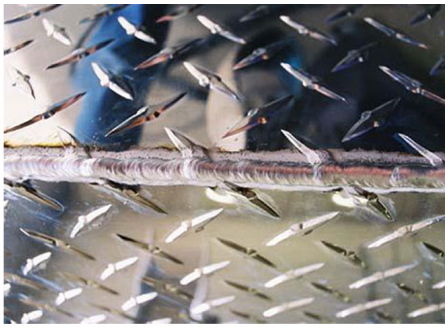
John F. Kennedy Space Center's Radiographic Thickness Measurement Method





BENEFITS

- Lower operating costs
- Low switching costs
- Faster results
- High fidelity
- Guaranteed conservatism
- Increased field of view
- Increased access
- Compatibility with preexisting radiographs
- Thickness determination from radiographs

opportunity

The National Aeronautics and Space Administration (NASA) seeks partners interested in the commercial application of the Radiographic Thickness Measurement Method. NASA's Kennedy Space Center (KSC) is offering companies licensing or partnering opportunities in the development of this innovative technology.

Researchers at KSC have developed a method by which a quantitative measurement of a homogeneous object's thickness or a change in thickness can be made using radiographic (X-ray) techniques.

Until recently, quantitative use of X-ray images has primarily been limited to a two-dimensional (length and width) examination of indications such as cracks, voids, and inclusions. Using X-ray techniques to make three-dimensional quantitative measurements has been considered too complex to achieve because of uncertainties in the thickness direction. Thus, ultrasound (UT) has remained the primary method of obtaining critical quantitative thickness measurements. However, as a point-of-contact method, UT is very costly to apply, especially to large areas, and is not effective for inspecting inaccessible or space-restrictive areas of an object.

APPLICATIONS

- Nondestructive evaluation
- Nondestructive testing
- Dimensional analysis and verification
- Weld verification
- Quality control

TECHNOLOGY STATUS

- ☐ Patent pending
- ☐ U.S. patent
- ☐ Copyrighted
- ☑ Available to license
- ☐ Available for no-cost transfer
- ☐ Seeking industry partner for further codevelopment

NASA's novel analysis method avoids these limitations. This technology can be used on inaccessible critical areas (such as welds inside completed pressure vessels), can be performed with minimal labor, and, from research to date, has delivered repeatable results, with uncertainties on the order of 1 mil for thin-walled pressure vessels.

Implementing this technology is economical because it uses X-ray equipment already in place. It can also be applied to archived radiographic film images. Moreover, it is particularly compatible with the next generation of X-ray nondestructive testing (NDT) inspection systems, which are based on digital radiography (DR).

Because of the high cost of using UT to dimensionally analyze the elements of complex systems and the low cost of implementing this technology, the potential exists for this technology to revolutionize the NDT community's approach to dimensional analysis.

Technology Details

NASA uses pressure vessels to store and supply propellants on space vehicles. During manufacturing of the Delta II rocket, a line of pressure vessels was found to have wall thicknesses below the allowable design tolerances. This prompted the evaluation and analytical verification of a supplier's products going back over five years.

Because of the nature of manufacturing, X rays were kept of all pressure vessel weld areas. The traditional evaluation requires qualitatively identifying thickness variations in an X ray, tediously locating the areas of interest on the pressure vessel, and then manually testing the part with an ultrasonic probe. In the past, such efforts consumed enormous resources and created costly delays. Since the advent of this new technique, NASA has been able to increase the field of view for areas of interest, reduce the cost and time required to properly analyze suspect conditions, and ultimately decrease the risk level of launching space vehicles.

This technology uses digitized and digital radiographs of an object to quantitatively measure changes in its thickness. Research pertaining to this technique included integrated and overlapping UT/innovation testing of flight hardware. The method was consistently proven accurate with UT probe testing in the field. This method was cross-checked for consistency in providing conservative measurements over 20 times using flight hardware and associated NDT data. Furthermore, research conducted with a tapering wedge with flat bottom holes verified the scientific principles and assumptions incorporated into this new technology.

Partnership Opportunities

All NASA licenses are individually negotiated with the prospective licensee, and each license contains terms concerning commercialization (practical application), license duration, royalties, and periodic reporting. NASA patent licenses may be exclusive, partially exclusive, or nonexclusive. If your company is interested in the Radiographic Thickness Measurement Method, or if you desire additional information, please reference Case Number KSC-13206 and contact:

Jeff Kohler
Innovative Partnerships Program
Mail Code: ESC-22
Kennedy Space Center, FL 32899
Telephone: (321) 861-7158
Fax: (321) 867-2050
jeffrey.a.kohler@nasa.gov

National Aeronautics and Space Administration

John F. Kennedy Space Center
Kennedy Space Center, FL 32899
www.nasa.gov/centers/kennedy

www.nasa.gov

SP-2010-10-230-KSC